Subject Index

Aa 395 actinolite 17 activation energy, zircon dissolution in anatectic melts 72 activities, metamorphic reaction zones 19f. activity/composition relations, clinopyroxenes 130 -, granitic pyrrhotite 63 -, igneous systems 114f. -, K-feldspar 130 -, leucite 131 -, melilite 131 -, olivine 130 -, orthopyroxene -, spinels 131 adamellite 33 aegirine 366 akermanite 118 albite 118 alkali basalts 182f. alkalic lavas 391 alkalic volcanic suites 182f. alkali feldspar 219 alkali olivine basalt 112 alkali volcanic rocks, source region 188 Al-pyroxene+spinel, thermodynamics 85 alteration, rhyolites 282f. -, Santorini lavas 45 amphibole 247, 260 -, trace elements 157 amphibolite 7 analcime 355f., 360 andalusite 58 andesine 45 andesite 2, 45f., 112, 182f. -, density 2 ankaratrite 123 anorthite 118, 175 anorthosite 327ff. anthophyllite 18, 217 apatite 45, 165, 183, 279, 329 arc formation, plate tectonics 91 Archean greenstone belts 6,25 armalcolite 229

basaltic komatiite 8f.
basalts, Hawaii 390f.
-, komatiitic 6f.
-, petrogenesis, case studies 382ff., 390ff.
-, -, Cr influence 179f.
-, -, geochemical case studies 382ff.
basanite 112, 183
batholiths, Pilbara 26f.
biotite 16, 165, 217, 245, 257f., 279
-, inclusions 58
bleaching, rhyolites, Sr depletion 286f.
blythite 199f.
bornite 59

arsenopyrite 59

augite 45, 183

Basalt 45f., 112

Calc-alkaline magmatism, Pilbara 25f. calcite 16 caldera, Roccamonfina 235f.

calderite, occurrence 200 -, synthesis and stability 199ff. calibration, thermodynamics of igneous systems 108f. carbonatites 365f. chalcopyrite 59 chemical analysis -, aegirine, fenite 368 -, amphibole, mylonites 261 -, analcimes, sills 356 -, basaltic lavas, Hawaii 392 -, basanites, Raton-Clayton 184 -, biotite, mylonites 259 -, -, trachytic tuff 246 -, chalcopyrite, granite 61 -, chevkinite 375 -, chlorite, rodingite 149 -, clinopyroxenes, pyroxenite nodules 74 -, -, serpentinized peridotite 79 -, -, trachytic tuff 245 -, -, wolgidite 231 -, cumulates, layered intrusions 335 -, diopside, rodingite 150 -, feldspars, sills 356

-, glass 294
-, -, Roccamonfina 239
-, gneiss, Pilbara 30
-, granite standard 28
-, hydrogrossular, rodingite 148
-, ilmenite, granite 62
-, lamellar intergrowths, olivine pyroxenite 78

-, lamprophyllite, fenite 368
-, lavas 112, 123
-, leuconorite 343
-, loparite 373
-, mesoperthite, layered intrusions 334

-, -, trachytic tuff 244

-, mixed-layer chlorite-smectite, rodingite
149
-, mylonites, California
-, nephelines, fenite
368

-, -, sills 356 -, nephelinites, Raton-Clayton 184 -, olivine, trachytic tuff 245 -, orthopyroxenes, wolgidite 231 -, perrierite 376

perilette 376
phlogopite, wolgidite 232
pumpellyite, rodingite 148
pyrite, granite 61

–, pyroxenes, layered intrusions 333–, pyrrhotite, granite 61

-, rhyolites, Schwarzwald 274, 282

-, rutile, granite 62
-, sanidine, fenite 368
-, Shaw batholith 30
-, sphene, trachytic tuff 247
-, Sr-loparite 373

-, Sr-loparite 373 -, Sr-perrierite 376 -, tausonite 373

-, titanomagnetite, trachytic tuff 246 -, trachytic tuff, Roccamonfina 239

–, vesuvianite, rodingite 149–, wolgidite 228

chemical zonation, magma chambers 152f. chevkinite 366 chlorite 7, 79, 147f., 217 clinopyroxene 17, 118, 183, 230, 244, 400 -, phenocrysts in ultramafitites, lamellae 74f. -, trace elements 158 clinopyroxene crystallization, experimental basalt petrogenesis 305f. clinopyroxene/garnet/orthopyroxene equilibria, ultramafifites 75 CO2, presence in deep crust 15f. -, -, origin 21 continental crust 1f. cordierite 16, 58, 216 -, mixing properties 84f. corundum 58 covelline 59 Cr, effect on phase relations in the join forsterite-anorthite-diopside 174f. -, komatiites 8 cratonization, Arabian-Nubian Shield 91 crinanite 356 crustal evolution, Pilbara 25f. crust-mantle boundary, concepts 1f. crystal fractionation, basalt petrogenesis 13 -, Santorini lavas 43, 48 ff. -, -, modelling 51 f. -, trachytic tuff 249f. crystal growth experiments, interpretation of igneous rock genesis 108f. crystallization, experimental basalt petrogenesis 304f. crystallization trends, sills 357f. cummingtonite 16 cumulus assemblages, Tigalak layered intrusion 330f.

Dacite 45f., 182f. Dahl's thermometer 192 deformation, granitic rocks 253ff. dehydration, staurolite 38f. dehydration equilibria, staurolites 41 f. dendritic melting pattern, plagioclases 349 densities, rocks 2f. density filter, crust 1f. differential partial melting, komatiite genesis diffusion, Zr in felsic rocks 67f. diffusion coefficient estimation, plagioclase melting 353 diopside 16, 118, 147, 175 diorite 327ff. -, density 2 dioritic pillows, origin 341 disorder, spinel 84 dissolution kinetics, zircon in anatectic melts 70f. distribution coefficients, liquids/minerals, Santorini lavas 53 -, mineral/melt equilibria 312f. -, mineral/phonolitic melt 153ff. dolerite 357 dunite 74

Eclogite nodules, leptynites 74 enstatite 118 enthalpies of formation, igneous minerals 134 f.

Subject Index

Aa 395 actinolite 17 activation energy, zircon dissolution in anatectic melts 72 activities, metamorphic reaction zones 19f. activity/composition relations, clinopyroxenes 130 -, granitic pyrrhotite 63 -, igneous systems 114f. -, K-feldspar 130 -, leucite 131 -, melilite 131 -, olivine 130 -, orthopyroxene -, spinels 131 adamellite 33 aegirine 366 akermanite 118 albite 118 alkali basalts 182f. alkalic lavas 391 alkalic volcanic suites 182f. alkali feldspar 219 alkali olivine basalt 112 alkali volcanic rocks, source region 188 Al-pyroxene+spinel, thermodynamics 85 alteration, rhyolites 282f. -, Santorini lavas 45 amphibole 247, 260 -, trace elements 157 amphibolite 7 analcime 355f., 360 andalusite 58 andesine 45 andesite 2, 45f., 112, 182f. -, density 2 ankaratrite 123 anorthite 118, 175 anorthosite 327ff. anthophyllite 18, 217 apatite 45, 165, 183, 279, 329 arc formation, plate tectonics 91 Archean greenstone belts 6,25 armalcolite 229

basaltic komatiite 8f.
basalts, Hawaii 390f.
-, komatiitic 6f.
-, petrogenesis, case studies 382ff., 390ff.
-, -, Cr influence 179f.
-, -, geochemical case studies 382ff.
basanite 112, 183
batholiths, Pilbara 26f.
biotite 16, 165, 217, 245, 257f., 279
-, inclusions 58
bleaching, rhyolites, Sr depletion 286f.
blythite 199f.
bornite 59

arsenopyrite 59

augite 45, 183

Basalt 45f., 112

Calc-alkaline magmatism, Pilbara 25f. calcite 16 caldera, Roccamonfina 235f.

calderite, occurrence 200 -, synthesis and stability 199ff. calibration, thermodynamics of igneous systems 108f. carbonatites 365f. chalcopyrite 59 chemical analysis -, aegirine, fenite 368 -, amphibole, mylonites 261 -, analcimes, sills 356 -, basaltic lavas, Hawaii 392 -, basanites, Raton-Clayton 184 -, biotite, mylonites 259 -, -, trachytic tuff 246 -, chalcopyrite, granite 61 -, chevkinite 375 -, chlorite, rodingite 149 -, clinopyroxenes, pyroxenite nodules 74 -, -, serpentinized peridotite 79 -, -, trachytic tuff 245 -, -, wolgidite 231 -, cumulates, layered intrusions 335 -, diopside, rodingite 150 -, feldspars, sills 356

-, glass 294
-, -, Roccamonfina 239
-, gneiss, Pilbara 30
-, granite standard 28
-, hydrogrossular, rodingite 148
-, ilmenite, granite 62
-, lamellar intergrowths, olivine pyroxenite 78

-, lamprophyllite, fenite 368
-, lavas 112, 123
-, leuconorite 343
-, loparite 373
-, mesoperthite, layered intrusions 334

-, -, trachytic tuff 244

-, mixed-layer chlorite-smectite, rodingite
149
-, mylonites, California
-, nephelines, fenite
368

-, -, sills 356 -, nephelinites, Raton-Clayton 184 -, olivine, trachytic tuff 245 -, orthopyroxenes, wolgidite 231 -, perrierite 376

perilette 376
phlogopite, wolgidite 232
pumpellyite, rodingite 148
pyrite, granite 61

–, pyroxenes, layered intrusions 333–, pyrrhotite, granite 61

-, rhyolites, Schwarzwald 274, 282

-, rutile, granite 62
-, sanidine, fenite 368
-, Shaw batholith 30
-, sphene, trachytic tuff 247
-, Sr-loparite 373

-, Sr-loparite 373 -, Sr-perrierite 376 -, tausonite 373

-, titanomagnetite, trachytic tuff 246 -, trachytic tuff, Roccamonfina 239

–, vesuvianite, rodingite 149–, wolgidite 228

chemical zonation, magma chambers 152f. chevkinite 366 chlorite 7, 79, 147f., 217 clinopyroxene 17, 118, 183, 230, 244, 400 -, phenocrysts in ultramafitites, lamellae 74f. -, trace elements 158 clinopyroxene crystallization, experimental basalt petrogenesis 305f. clinopyroxene/garnet/orthopyroxene equilibria, ultramafifites 75 CO2, presence in deep crust 15f. -, -, origin 21 continental crust 1f. cordierite 16, 58, 216 -, mixing properties 84f. corundum 58 covelline 59 Cr, effect on phase relations in the join forsterite-anorthite-diopside 174f. -, komatiites 8 cratonization, Arabian-Nubian Shield 91 crinanite 356 crustal evolution, Pilbara 25f. crust-mantle boundary, concepts 1f. crystal fractionation, basalt petrogenesis 13 -, Santorini lavas 43, 48 ff. -, -, modelling 51 f. -, trachytic tuff 249f. crystal growth experiments, interpretation of igneous rock genesis 108f. crystallization, experimental basalt petrogenesis 304f. crystallization trends, sills 357f. cummingtonite 16 cumulus assemblages, Tigalak layered intrusion 330f.

Dacite 45f., 182f. Dahl's thermometer 192 deformation, granitic rocks 253ff. dehydration, staurolite 38f. dehydration equilibria, staurolites 41 f. dendritic melting pattern, plagioclases 349 densities, rocks 2f. density filter, crust 1f. differential partial melting, komatiite genesis diffusion, Zr in felsic rocks 67f. diffusion coefficient estimation, plagioclase melting 353 diopside 16, 118, 147, 175 diorite 327ff. -, density 2 dioritic pillows, origin 341 disorder, spinel 84 dissolution kinetics, zircon in anatectic melts 70f. distribution coefficients, liquids/minerals, Santorini lavas 53 -, mineral/melt equilibria 312f. -, mineral/phonolitic melt 153ff. dolerite 357 dunite 74

Eclogite nodules, leptynites 74 enstatite 118 enthalpies of formation, igneous minerals 134 f. enthalpies of fusion, minerals of igneous systems 123f. entropy changes, system MgO-Al₂O₃-SiO₂ 84f. epidote 263

equilibrium, igneous systems, Gibbs free energy determination 108ff.

-, temperature and pressure, clino- and orthopyroxenes and garnet in leptynites

essexite 357 exchange reactions, staurolites 40f.

Favalite 118 feldspars, Pb isotopic investigation 92f. fenite 366f. ferrosilite 118 fluid inclusions, granulites 15f. forsterite 118, 174f. forsterite-anorthite-diopside, effect of Cr on phase relations 174ff. forsterite + cordierite, thermodynamics 84 ff. fractional crystallization, alkali volcanic rocks 186f. -, basalt petrogenesis 382f.

-, layered intrusion 327ff.

fractional crystallization trends, sills 359 fractionation correction, basalt petrogenesis 383

free energy of mixing, thermodynamics of igneous systems 109f, 117f. fugacities, O and S, magma crystallization

58f.

Gabbro 74, 150 galena, Pb isotopes 94f. garnet 16, 58, 216, 247 -, Mn-~, stability 199ff. garnet-clinopyroxene geothermometry, granulites 191f. garnet lamellae, clinopyroxene phenocrysts 74 garnet lherzolite model, basalt petrogenesis 401 geikielite 118 geobarometry, metapelitic gneisses 219f. geochronology, Arabian-Nubian Shield 94ff.

-, Pilbara batholith 27f. geothermometer, oxide and sulfide minerals in granites 58

geothermometry, metapelitic gneiss 219f. Gibbs free energy, igneous rock petrogenesis 108f.

-, liquids 109f. glass 45, 238 gneiss 15f., 26f., 215fl, 272

granite 28f., 91, 255, 272 -, density 2

-, sulfide/oxide paragenesis 58ff.

granodiorite 27f, 58, 91, 328 granulite 74, 215ff.

-, geothermometry 191 ff. granulite facies terrain, metasomatic zones 15f., 193

graphite 16 greenstone belt 6 greenstone sequence, Pilbara 25f. grossular 19

Harzburgite 183 hauyne 183 -, trace elements 157 hedenbergite 118 hematite 202 hercynite 118 hopper crystals, komatiites 7 hornblende 16, 58, 260f. hornblendite 74 hydrogarnet 147 hydrogrossular 148 hypersthene 45

Igneous differentiation 310f. igneous phase relations, determination 108f. igneous rocks, cooling history and origin interpretation 107ff. igneous systems, basic thermodynamic expressions 109f. ignimbrite 273, 282 ilmenite 16, 45, 58f., 118 ilmenite/melt equilibria, mixing properties 316 incompatible elements vs. Th, Santorini lavas 48f. intergrowths, lamellar pyroxenes 76f. island arc, Hellenic 44 I-type granites, Japan 58

Kalifeldspar 118, 284 kalsilite 366 komatiite 2, 123 -, peridotitic 6f. -, pyroxenitic 6f. kyanite 216

Labradorite 345 lamellae, pyroxenes in ultramafic nodules 74f. lamellar intergrowths, pyroxenites 76 lamellar pyroxenes, ultramafitites 73 ff. lamprophyllite 366 larnite 123, 183 lattice rotation, lamellar pyroxenes 80f. lava, basalt petrogenesis 391 f. -, Roccamonfina 235f. lava flows, Lac Guyer 6f. lava sequences, Santorini 43ff. layered intrusion, Labrador, petrogenesis 327ff. leaching, rodingite 150 leptynite, lamellar pyroxenes 74f. leucite 118 leucite basanite 112 leucite lamproites, experim. study 228f. leucite melilite 113 leucite phonolites 235f. leucite tephrites 235f. leuconorite 342 liquid immiscibility, silicate liquids 124f. -, thermodynamics of igneous systems

liquids, thermodynamic properties 108ff.

liquid/solid equilibria, coefficients 139

loparite 365 -, X-ray data 371

Magma chamber, layered intrusion petrogenesis 327f. -, stratified 152f. magma densities 2f. magma fractionation calculation, Hawaiian basalts 396 magma mixing, layered intrusion petrogenesis 327ff. magmas, thermodynamic modelling 109ff. magmatic processes 107f. magnetite 16, 45 -, trace elements 157 mantle, source of wolgidite magma 232 mantle metasomatism 188 marble 15f. meionite 19 melilite 183 melilite leucitite 113 melting experiments, basalt petrogenesis -, interpretation of igneous rock genesis 108f. melting kinetics, plagioclase 345ff. mesoperthite 334 metapelites 215f, metasomatic zones, granulites 15ff. metasomatism, mantle 182 ff. -, rodingite 149 micas, rhyolites, Rb-Sr age determination 276 -, trace elements 159 microcline 16 mid-ocean ridge basalts, composition variations 293f. migmatites 215 mineral/melt equilibria 108ff. -, mafic systems 310 ff. -, thermodynamics 312 mixed-layer chlorite-smectite 147f. mixing properties, mineral/melt-equilibria 311f. models, Santorini volcanic series 43f. Moho concepts 1f. multiphase equilibria, igneous systems 124f. muscovite 58, 217, 264, 272, 288 mylonites 253ff.

Nb-chevkinite 376 nepheline 183, 355, 366 -, crystallization trends in sills 359 nephelinite 113, 183f. Ni, komatiites 8 nodules, ultramafic, leptynites, lamellar pyroxenes 74f.

mylonitic zones, California 257f.

-, metamorphic grade 267f.

mylonitization 255f.

myrmekite 16

Obduction, lower crust 3 obsidian, Zr distribution 67f. oceanic crustal environment, development of Arabian-Nubian Shield 92f.

oceanic mid-plate volcano 390 ocean ridge basalts 293f.
O fugacities, effect on spinel/melt equilibria 315
-, Fe²⁺/Fe³⁺ equilibria 109f.
-, influence on calderite synthesis 203
O isotopic ratios, granite types 64

O isotopic ratios, granite types 64 olivine 45, 75, 109, 118, 183, 228, 246, 357, 400 —, activity coefficients of minor components

121 olivine/liquid equilibria 125f.

-, mixing properties 315 olivine nephelinite 183 olivine pyroxenite 75 olivine spinifex 7 olivine theralite 356 opal 74 ophiolites 146

230

order-disorder, cordierite, Al-ortho-pyroxene and spinel 88 orthoclase, inclusions 58 orthoamphibole 219 orthopyroxene 16, 58, 75f., 118, 183, 217,

–, mixing properties 84f.
orthopyroxene lamellae, clinopyroxene phenocrysts 74

Pahoehoe 395 paragarnet 149 partial melting 43 -, alkali volcanic rock genesis 186f.

-, alkali volcanic rock genesis 1861.

-, basalt petrogenesis 387

-, feldspars 345f. -, komatiites 6f.

Pb isotopic compositions, Arabian-Nubian Shield 94ff.

-, Shaw batholith 28 peridotite, clinopyroxenes 75f. peridotitic komatiite flows 6f. perovskite 365 perrierite 372

phase boundaries between host and lamellae in ultramafic rocks 80 f.

phase diagrams, interpretation of igneous rock genesis 107f.

phase equilibria, mafic systems 310ff. phase equilibria calculation 320f. phase relations, join forsterite-anorthite

phase relations, join forsterite-ano
-diopside, effect of Cr 174f.
-, silicate liquids 109f.
-, wolgidite 228f.

phenocryst calculations, lavas 127f.
 phenocrysts, clinopyroxenes in pyroxenites,

COTTOSION 75

-, Santorini 45
phlogopite 229
phonolite 153f., 235f.
-, magma chamber, trace eleme

 , magma chamber, trace element variations 152 ff.

picrochromite 175 pigeonite 45 pillow basalts 6 plagioclase 16, 45, 109, 118, 183, 219,

243, 329

—, activity coefficients of minor components

-, experim. partial melting 345f.

-, inclusions 58
-, mylonites 263
-, trace elements 156
plagioclase/melt equilibria, mixing properties 316
plate tectonics 91
polymerization, melt silicate network 153
porphyries, Permian, Schwarzwald 274, 282

polymerization, melt silicate network 153 porphyries, Permian, Schwarzwald 274, 282 priderite 229 primary melts, basalt petrogenesis, trace

primary melts, basalt petrogenesis, trace element concentrations 384 f. protomylonite 255

pumice, trachytic tuff 237f. pumpellyite 146f. pyrite 58f. pyroclastics 237f. –, Eifel 153f. pyropen 18 pyroxene 329

pyroxene/melt equilibria, mixing properties

pyroxenite 74
pyroxenitic komatiite flows 7
pyroxmangite 202
pyrrhotite 58 f.

Quartz 16, 45, 119, 256f., 284

-, inclusions 58 quartz diorite 91 -, density 2

Rare earth elements, basalt petrogenesis 387

-, komatiites 8

–, komatities and mantle melt products
 11

Rb-Sr age determination, Schwarzwald rhyolites 276f.

Rb-Sr dating, distortion by rhyolite alteration 282f.

Rb-Sr isotopic compensation, Shaw batholith 28

reaction zones, metasomatic, deep crustal carbonates 18f. redox equilibria, staurolites 41

regression equations, thermodynamics of igneous systems 138f.

residual zircons, anatexis 66f.

rhyodacite 45f. rhyolite 6

-, geochronology 272f. rifting, Arabian-Nubian Shield 91 rock densities 2f.

rodingite 146f. rutile 58, 229

Salite 17
saturation behaviour, Zr in H₂O-bearing
melt 72
sanidine 118, 238, 272, 279, 366
–, trace elements 156
sapphirine granulites 215f.

scapolite 17
sericitisation, rhyolites 287
serpentine 7
serpentinisation 73

shear zones, California 253 f.
silica activity, basic lavas 119 f.
silicate liquids, multicomponent calculation
of magmatic intensive variables 108 ff.
silicate melts mixing properties 312 f

silicate melts, mixing properties 312 f. sills, alkaline basis, differentiation 355 f. S isotopic ratio, granite types 64

sillimanite 16, 58, 216f. skiagite 199f.

Sm/Nd, mantle metasomatism 188 solid solution, granitic pyrrhotites and ilmenites 63

solution model extension, silicate liquids 121f.

-, thermodynamics 108f. sphene 16, 58, 247, 366

-, mylonites 263 -, trace elements 158

spinel 58, 75, 118, 174f., 216 –, mixing properties 84f.

spinel/melt equilibria, mixing properties 317 spinel/melt experiments 311f.

spinifex textures, komatiites 7
Sr isotopes, Hawaiian lavas, relation to trace

elements 398f. Sr-perrierite 376

staurolite, OH-content 36f. stratovolcano, Roccamonfina 236 -, Santorini 44

strontian-loparite 365f.

-, X-ray data 371 strontio-chevkinite 366f. S-type granites, Japan 58 substitution, OH in staurolites 4

substitution, OH in staurolites 40 f. sulfide deposits, Arabian Shield, Pb isotopes 92 f.

sulfide parageneses, granitic rocks 58 ff. systems, Fe-Mn-Si-O 199 f.

-, MgO-Al₂O₃-SiO₂ 84 f.

Tausonite 365
-, X-ray data 371
tephra, Laacher See 153f.
tephroite 123
teschenite 357
texture of melting, plagioclases 347f.
Th, Santorini lavas 49f.
Th-chevkinite 376
theralite 356

thermodynamic calculations, igneous systems 133 f. thermodynamic expressions, igneous systems 109 f.

thermodynamic intensive variables, igneous rocks 107ff.

thermodynamic properties, igneous systems

tholeiite 113, 391 f. -, density 2

titanomagnetite 58f., 246 tonalite 91, 255

trace element modelling, lavas 382 ff. trace elements, basalts associated with

komatiites 10 –, Hawaiian basalts 394

Hawaiian basalts 394
komatiites 7f.
nephelinites 185

-, phonolites 154f.

- -, rodingite 150
 -, Santorini lavas 46
 -, trachytic pumice 240
 trachytosalt 112
 trachytic tuff 237 ff.
 tremolite 7
 trondhjemite 91
 tuff, trachytic 235 ff.
- Variation diagrams, Santorini lavas 49
 vermiculite 79
 vesuvianite 147f.
 volcanic series, Santorini, trace element
 geochemistry 43ff.
 volcanism, Eifel 153
 –, Lac Guyer 6f.
 –, Permian, Schwarzwald 272f.
 –, Santorini 44f.
 volume of mixing, liquids 109
- Zeolites 45
 zircon dissolution, influence of H₂O and T 67f.
 zircon saturation, melts 71
 zircon solubility, anatectic melts 67f.
 Zr, diffusivity in obsidian melts 68f.
 –, komatiites 8

whole rock dating, Rb/Sr, distortion 281 f.

wolgidite 228f.

wollastonite 19

- Ugandite 112
 ultramafitites, Lac Guyer greenstone belt 6f.
 ulvospinel 118
 underplating model 2f.
 upper mantle, rock densities 1f.
- Wadeite 366 water analyses, staurolites 37 websterite 183 wehrlite 183